ORIGINAL

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
The Development of Operational, Technical and Spectrum Requirements For Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010	)	WT Docket No. 96-86

To: The Commission

COMMENTS OF THE AIR TRAVELERS ASSOCIATION, AMERICAN AIRLINES, THE GENERAL AVIATION MANUFACTURERS ASSOCIATION, OUTREACH, STANFORD UNIVERSITY (THE GPS RESEARCH PROGRAM), THE U.S. GPS INDUSTRY COUNCIL, AND UNITED AIRLINES

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SUMMARY

The U.S. GPS Industry Council ("the Council"),The Air Travelers Association, American Airlines, the General Aviation Manufacturers Association, Outreach, Stanford University (The GPS Research Program), and United Airlines (collectively referred to as "GPS Commenters"), by its attorneys, hereby comment in response to the notice of proposed rule making regarding the development of operational, technical and spectrum requirements for meeting federal, state and local public safety agency communications requirements through the year 2010. In these comments, the GPS Commenters demonstrate that it is premature for the Commission to adopt standards of general applicability for wideband emissions for systems operating in the 794-806 MHz band as such standards would lead to harmful interference.

Under the proposed Section 90.553 Commission rule, second harmonic emissions from systems in the 794-806 MHz band would cause harmful interference to Global Positioning System ("GPS") receivers operating in the 1559-1610 MHz band. This interference would lead to the loss of GPS signal reception or errors in position or time accuracy. Either of these consequences in intolerable for a safety-of-life service, such as the GPS — which has millions of users in safety-of-life applications.

The GPS Commenters note that the Commission is obliged to protect safety of life services — such as radionavigation satellite services ("RNSS") in which GPS operates — are protected from harmful interference. The Commission must protect safety services from harmful interference under the International Telecommunication Union ("ITU") Radio Regulation ("RR") S4.10 and under its own rules which are designed to protect safety-of-life services from harmful interference.

Further, basic, but critical, assumptions taken in the rule making proceeding are

technically and legally deficient. First, the proposed power spectral density level of -70 dBW/MHz was developed under distance and shielding assumptions that do not apply to critical land and marine safety-related applications where the GPS and MSS transreceivers can be expected to interact — thus not protecting GPS receivers in scenarios that are very likely to emerge with 700 MHz public safety systems.

Second, the GPS Commenters do not believe that the Commission can afford to engage in a "traditional" weighing of the impact of imposing standards on the makers of 700 MHz equipment on the practicality of the use of that band for public safety use. It is inconsonant with the public interest for the Commission to adopt rules that establish the groundwork for a *new* public safety system that would, by its very existence, endanger a dynamic, growing, and absolutely vital *existing* public safety service.

Third, the GPS Commenters question the Commission's desire for a "better understanding" of the levels of interference currently existing in the Global Navigation Satellite Systems ("GNSS") spectrum. Current levels of interference in the relevant spectrum is not the question. If anything, the existence of interference from other sources heightens the need for the Commission to be vigilant in ensuring no additional interference is introduced to the GPS band.

If at the end, there are no alternatives to protect the GPS bands, the Commission should establish the minimum second harmonic suppression standard in the frequency range of 1550-1605 MHz to 120 dB, for mobile units, and to 110 dB, for handhelds and portable units, down from the maximum effective radiated power of the carrier in both cases. The GPS Commenters note that such a solution should be technically feasible and necessary, irrespective of cost considerations, to protect GPS receivers.

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The U.S. GPS Industry Council ("the Council"), the Air Travelers Association,[1/] American Airlines, the General Aviation Manufacturers Association, Outreach, Stanford University (the GPS Research Program), and United Airlines (collectively referred to as "GPS Commenters"), by counsel and pursuant to Sections 1.415 and 1.419 of the Commission's rules,[2/] hereby submit their comments in response to the notice of proposed rule making in the above-referenced proceeding.[3/] In its *NPRM*, the Commission seeks, among other things, to adopt emissions limits for transmitters operating in the public safety spectrum at 794-806 MHz in order

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1/ The Air Travelers Association represents the flying public.

2/ 47 C.F.R.§§ 1.415 and 1.419.

3/ *See The Development of Operational, Technical and Spectrum Requirements For Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010*, First Report and Order and Third Notice of Proposed Rulemaking, WT Docket No. 96-86 (FCC 98-191) (released September 29, 1998) ("*NPRM*").

to protect the Global Navigation Satellite System ("GNSS") in the 1559-1605 MHz frequency band from harmful second harmonic emissions.[4/] The GPS Commenters assert herein that the Commission the emission standards for systems operating in the 794-806 MHz band will result in harmful interference to the GPS frequency band. Such interference would end the continuous availability of GPS and the Global Navigation Satellite System ("GLONASS"), where that continuity is an operational requirement for a broad range of commercial and public safety users. A rapidly expanding variety of consumer applications also depend on the uninterrupted continuity of the GPS service. The GPS Commenters note that 8 million GPS receivers are in use today, with over 3 million car navigation users in Japan alone according to recent data from the Japan GPS Council.

These users can rely on GPS with confidence based on the U.S. commitment to the "continuous availability of GPS" announced in the Presidential Decision Directive ("PDD") of March 29, 1996. Congress endorsed this commitment in statute with the Defense Authorization Act of 1998 ("PL 105-85") signed into law by the President. Congress further directs the Administration to "protect the integrity of the Global Positioning System frequency spectrum against interference and disruption" in the Defense FY99 Appropriations Conference Report and in the Commercial Space Act of 1998.[5/]

[4/] *See Id.*, at 92 (¶ 199). As the Commission explained in the *NPRM*, the Global Positioning System ("GPS") will be the United States component of the GNSS. *See id.* at 90 n.514. GPS utilizes the lower portion of the Radionavigation-Satellite Service (space-to-Earth) allocation from 1559-1610 MHz on a primary basis, and is maintained by the United States Department of Defense. *See id.*

[5/] H.R. 105-746, Defense FY99 Appropriations Conference Report; H.R. 1702 Commercial Space Act of 1998.

Many GPS receivers are used for land and maritime safety applications. Some of this critical equipment is used in ambulances, police cars, fire engines, for harbor-harbor entrance navigation, search and rescue, and docking of large marine vessels, such as oil tankers and high-speed ferries. These applications *do share* the public safety mandate that applies to aircraft operations – the GNSS signals must be continuously available without disruption due to interference. However, they *do not share* the operational characteristics that have been used when considering interference to aviation from mobile earth terminals ("METs") operating in the mobile satellite service ("MSS") band from 1610-1626.5 MHz. In developing the specific interference number for this aircraft landing scenario, the minimum separation between the MET's handset on the ground, and the GPS receiver on the aircraft was assumed to be 100 feet, with the fuselage of the aircraft providing interference attenuation.

Indeed, the 100 foot separation is clearly not applicable when considering interference to the mobile GPS user base (e.g., public safety vehicles) from a nearby mobile METs handset. In fact, 700 MHz public safety radios are likely to be collocated in the same vehicle with GNSS equipment, as they are used to coordinate the same emergency missions. It appears contrary to the public interest to introduce disruption to a marketplace where the operational standard requires synergy between communications and positioning. Based on this trend, it can be expected that all public safety users will be equipped with GPS location devices. It is difficult to understand why anyone would propose for this public safety marketplace, radios with second harmonic emissions that are harmful to the continuous availability of GPS positioning information and to the public safety equity of the consumer.

GLONASS, the Russian GNSS, would be similarly devastated by the proposed harmonic emission levels. This system has been developing more slowly than GPS, and currently augments GPS capability. It is generally believed that GLONASS will mature to play an important synergistic role. Significantly, the Russians successfully added three more satellites to their constellation in December, 1998.This portion of the band is reserved for aeronautical safety of life applications and, by this allocation definition, is required to serve that purpose. The current plans to expand and modernize the GPS signal structure clearly recognize that GPS is rapidly becoming an international information utility serving a broad user base in public safety, commerce, and the individual consumer. This growth validates the efficient use and value of the entire ARNS band. The U.S. commitment to GPS modernization clearly bestows recognition of the urgent need to preserve the integrity of the band for future demand.

The GPS Commenters note that a suppression of 80 dB truly does not represent a meaningful attempt to be a responsible neighbor to a public safety band, given that the harmonic is located some 794 MHz above the proposed carrier. Furthermore, the technical capability exists to achieve greater suppression, and must be implementated to serve the public safety. Current practice is demonstrated by the out-of-band emission ("OOBE") mask of the MSS community which is guaranteeing 66 dB over a frequency span of only 5 MHz.

I. INTRODUCTION

The U.S. GPS Industry Council is a non-profit 501(c)(6) industry trade association whose mission is to be an information resource to the Government, the media, and the public on GPS. The Council's purpose is to promote sound policies for the development

of commercial markets in civilian application, while preserving the military advantages of GPS. Current membership includes the principal U.S. manufacturers of GPS equipment — e.g., Boeing, Honeywell, Magellan/Ashtech, Rockwell International, and Trimble Navigation.

The Council represents a significant sampling of the hundreds of manufacturers of GPS equipment and the millions of users of GPS signals. On behalf of its numerous members, many of whom are engaged in activities with safety-of-life implications, the Council, along with the GPS Research Program of Stanford University and GAMA, is extremely concerned that the adoption of specific emission standards without considering all the operational and technical variations would lead to the loss of GPS signal reception or errors in position or time accuracy. Either of these consequences is intolerable for a safety-of-life service.

Outreach is a non-profit 501(c)(3) organization which provides paratransit support and other services for the elderly, handicapped and Alzheimer patients in San Jose, California.

GAMA is a national trade association representing 54 manufacturers of fixed-wing aircraft, engines, avionics and components. In addition to building all the general aviation aircraft flying in the United States today, GAMA member companies also operate aircraft fleets, airport fixed-base operations, pilot schools and training facilities across the country. General Aviation is a $15 billion industry which generates more than $45 billion annually in economic activity. General Aviation exports one-third of its production and leads the world in development of new technology aircraft.

Stanford University has been active in research in satellite navigation and GPS since 1989. At present, GPS research is conducted by four faculty, four professional researchers, and twenty five Ph.D. students. The research covers GPS augmentation for aviation using wide-

area differential GPS and local area differential GPS, elements which are instrumental to public safety in aviation. The research also covers GPS augmentation for agriculture and precision construction, again both of which have significant public safety responsibilities.

II. DISCUSSION

A. There Is An Absolute Requirement To Protect GPS And All Of Its Public Safety Applications (Land And Marine, As Well As Aviation).

GPS satellites broadcast a very low power, one-way, safety-critical signal. The received signal power only supports a data rate of 50 bits per second. The GPS signal comes from satellites that ar 11,000 miles away providing very lower power flux densities at the earth's surface. This means that the GPS signals are inherently susceptible to OOBE generated locally. This problem is aggravated by the mobile nature of the use of the proposed system.

Moreover, the basic GPS system architecture has been unchanged since its conception in 1973. It is a characteristic of the GPS system itself, and no retrofit of the receivers, itself impractical, could enable continuous availability in the proposed interference environments.

Based on the latest data, there are over eight million direct users of GPS around the world today. The number of indirect beneficiaries of the continued reliable operation of GPS -- from airline passengers to stock market investors to users of resources that are produced more efficiently as a result of GPS technology -- is well into the hundreds of millions.

Much of the use of GPS includes safety-of-life applications. In aviation, GPS is used for transoceanic and en route navigation, aids to landing, and for wind shear detection. In maritime environments, GPS is used for navigation on the high seas, search and rescue, positioning of buoys and marine navigation aids, docking of high-speed ferries, and precision coastal and harbor approach operations. In the differential beacon augmentation systems, GPS is used for increased accuracy in the coastal confluence zones of many nations around the world, and in surface transportation, GPS is used in such critical applications as monitoring of bridge status and train control, collision avoidance, and the transportation of hazardous materials. Also, GPS is an enabling technology for the nation's emerging Intelligent Transportation Systems ("ITS") infrastructure. Federal, state, and local governments are increasingly relying on GPS for use in ambulance, police and fire department dispatch, and to provide disaster management and relief for hurricanes, floods, earthquakes, and fires. This use clearly would be vulnerable to disruption from the proposed emissions. Furthermore, the cost of added filtering to remove the second harmonic of the carrier for vehicle-mounted radios is truly trivial. The cost to the U.S. taxpayer to sufficiently increase the GPS satellite power is in the order of billions of dollars.

The GPS Commenters observe initially that the Commission has a general obligation to ensure that safety services — such as the radionavigation satellite service ("RNSS") in which GPS operates — are protected from harmful interference. Under International Telecommunication Union ("ITU") Radio Regulation ("RR") S4.10, administrations must take into account in the assignment and use of frequencies the fact that

special measures are required to ensure that safety services are free from harmful interference.[6/] The Commission's rules reflect this requirement.[7/]

Due to the inherent nature of the safety-related uses of GPS, and the constraints imposed by the GPS system specification,[8/] the frequency bands used by GPS must be fully protected against interference from external sources.[9/] Contrary to the incomplete expression provided in the *NPRM*, however, this protection requirement extends to *all* of the safety applications of GPS, be they marine or land, and not just to aviation-safety applications associated with GNSS. To the extent that the Commission focuses its inquiry in the *NPRM* almost exclusively on aviation-related requirements, and either tacitly presumes that what is sufficient to protect GNSS would protect all other uses of GPS or ignores the broader safety-related applications of GPS altogether, the *NPRM* suffers from a glaring defect.[10/] The ramifications of this oversight, and the GPS Commenters' proposed rectifications, are presented below.

6/ *See* ITU RR No. S4.10.

7/ *See* 47 C.F.R. § 2.1(c)(1997) ("harmful interference," which is pervasively prohibited under the Commission's rules, is defined, in part, as "interference which endangers the functioning of a radionavigation service or of other safety services . . .").

8/ The GPS System Specification has been in the public domain since at least 1984.

9/ The importance of GPS and the need to ensure its protection is reflected in legislation as well as in the policy initiatives of the Executive Branch. *See, e.g.,* Presidential Decision Directive (1996); Defense Authorization Act (1997); Defense Appropriations Act (1998); Commercial Space Act (1998); Bilateral Agreement between the United States of America and Japan (1998).

10/ *See NPRM*, FCC 98-191, slip op. at 90-93 (¶¶ 196-201).

B. Second Harmonic Emmissions From Systems In The Band 794-806 MHz Would cause Harmful Interference to GPS Receivers.

Public safety systems operating in the 794-806 MHz (TV channels 68-69) band would produce second harmonic transmissions into the 1559-1610 MHz radionavigation satellite service ("RNSS") band that is used by GPS.[11/] The Commission recognizes that certain sensitive receivers can detect the transmitted energy on harmonic frequencies.[12/] GPS receiver systems are susceptible to both spurious and out-of-band interfering emissions. Again, these constraints are imposed by the GPS system design, not by the design of the user equipment. The second harmonic emissions from systems operating at 794-806 MHz would cause GPS receivers to suffer harmful interference. These emissions will significantly reduce the ability of a GPS receiver to acquire a GPS signal or to maintain tracking of a GPS signal, or will cause errors in position or time accuracy. **Any of these consequences is intolerable to the GPS user segment.**

The GPS Commenters recognize that the second harmonic from the bands 794-806 MHz, while falling into the upper part of the RNSS band that includes GPS, does not land directly on top of the current GPS frequency assignment (which covers roughly 24 megahertz of the RNSS band, from 1563.19 to 1585.65 MHz). Instead, this harmonic falls into the portion of the RNSS band that is used by the Russian Federation's GLONASS, which like GPS, is part of the GNSS. Nevertheless, the interference to be experienced by GPS systems from this second harmonic is indeed harmful, and must be prevented. In fact, there are currently users depending on dual GPS/GLONASS receivers for safety of life applications.

11/ *Id.* at 90 (¶196).

12/ *Id.* at 90 n.516.

In proposed Section 90.553 of its rules, the Commission is proposing to protect GNSS receivers by requiring that:

> mobile units must meet a minimum second harmonic suppression standard in the frequency range of 1559-1605 MHz of 90 dB down from the maximum effective radiated power of the carrier and handhelds and portable units must meet a minimum second harmonic suppression standard in the frequency range of 1559-1605 MHz of 80 dB down from the maximum effective radiated power of the carrier.[13/]

The rule would apply only to equipment that operates in the frequency range 779-802.5 MHz (*i.e.*, equipment that produces a second harmonic in the 1559-1605 MHz segment of the 1559-1610 MHz band).[14/] Under this standard, 30 Watt public safety mobile radios or 3 Watt handhelds and portable units operating in the lower end of the 794-806 MHz band would produce harmonics in the RNSS band at a level of -75 dBW -- some 89.5 dB above the GPS signal. The impact of such powerful harmonics that land just outside of the GPS assignment will block reception of the GPS signal or prevent the receiver from tracking, and have an obvious negative effect on pubic safety. In much the same way as a powerful bomb does not require pinpoint accuracy to cause devastation to its intended target, the powerful second harmonic of a 30 Watt mobile transmitter does not have to be right in the GPS assignment in order to devastate the operation of GPS.[15/]

13/ *NPRM*, FCC 98-191, slip op. at F-7 (Proposed New Section 90.553 of the Commission's Rules).

14/ *See id.*

15/ For this reason, Motorola, Inc. ("Motorola") was incorrect when it contended in comments that only a small portion of the 24 megahertz of public safety spectrum is impacted by this issue, and that there is no need to impose "onerous spurious attenuation requirements on public safety equipment that pose no interference risk to GLONASS or GPS, or delay deployment of systems operating in the band." *NPRM*, FCC 98-191, slip op. at 92 (¶ 198).

In an analysis appended to its *NPRM,* the Commission indicated that:

> A mobile with an output power of 30 watts operating on 800 MHz has an ERP of 14.77 dBW. A 3 watt handheld has an ERP of 4.77 dBW. The 30 watt mobile would need 95 dB of harmonic suppression to meet the -80 dBW level, and the 3 watt handheld would need 85 dB of harmonic suppression to meet the -80 dBW level. This compares to our present rules under Section 90.210 which requires 35 dB of suppression for out-of-band signals removed from the carrier up to 250% and 58 dB of suppression for 30 watt mobiles for signals over 250% and 48 dB of suppression for 3 watt mobiles.[16/]

These comments suggest that a radiated harmonic level of –80 dBW would be acceptable. As described below, nothing could be further from the truth, because the –80 dBW level was derived for an aircraft operational scenario that simply does not pertain to land and maritime emergency services. The Council is on record in previous filings that this aviation interference number is inadequate for other GPS use and even for aviation.

C. The Power Power Spectral Density Level Of -70 dBW/MHz, While Adequate To Protect GPS In Certain Scenarios, Would Not Protect GPS In Scenarios That Are Very Likely to Emerge With 700 MHz Public Safety Systems.

In its *NPRM*, the Commission requests comment on the validity of certain assumptions that underlie the National Telecommunications and Information Administration ("NTIA") proposal, *inter alia*, for out-of-band emission limits at the transmitter of -70 dBW/MHz for wideband emissions and -80 dBW/MHz for narrowband emissions to protect GNSS.[17/] Specifically, the Commission noted that the NTIA proposal, which is the subject of a pending petition for rule making, was based on an assumed separation distance of 30 meters between the offending transmitter -- i.e., mobile earth terminals for mobile-satellite service

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16/ *Id.* at G-1.

17/ *Id.* at 92 (¶ 199).

systems that operate in the 1610-1626.5 MHz and 2 GHz frequency bands -- and the victim GPS or GLONASS GNSS receiver for spurious or harmonic signals in the 1559-1605 MHz band.[18/]

The Council has had occasion in recent months to call into question the suitability of the final emission limit proposed by NTIA for emissions from 1.6 GHz MSS METs.[19/] It has noted, for example, that the NTIA proposal was derived to protect GPS receivers in a very specific scenario, and that as a result, the proposed standard may not provide adequate protection in scenarios where the assumptions are inapplicable.[20/]

In the specific case for which the NTIA proposal was developed, the victim GPS antenna is located on the top of an airplane, and the aircraft fuselage shields the antenna from any single interfering MSS MET located on the ground as the plane passes overhead.

18/ *Id.* at 92 (¶ 199).

19/ *See* Petition to Deny AirTouch Satellite Services US, Inc., Application for Blanket Authorization to Construct and Operate Mobile Satellite Earth Terminals ("METS") in File No. 1367-DSE-P/L-97, at 10-11 (filed June 19, 1998); Petition for Reconsideration Regarding the Application of U.S. Leo Services, Inc. for Consent to the Assignment of a Blanket Earth Station License to Iridium U.S., L.P., in File No. 1044-DSE-AL-98, at 3-4 (feiled August 31, 1998); Comments of the U.S. GPS Industry Council on the Commission's Proposal to Adopt Procedures for the Certification of Ground Segment Equipment for Use in the Provision of Global Mobile Personal Communications Services by Satellite ("GMPCS"), GEN Docket No. 98-68, at 6-7 (filed July 27, 1998).

20/ The Council has also questioned the suitability of the proposed –70 dBW/MHz emission limit to protect GPS from emissions from such distant interfering sources as RF lighting devises that are contemplated for operation in the 2.4 GHz band. *See* Reply Comments of the U.S. GPS Industry Council on RF Lighting Devices, ET Docket No. 98-42, at 4 (filed August 25, 1998).

Moreover, the MSS user is assumed to be at least 30 meters away from the GPS antenna at the time the aircraft is most vulnerable and sensitive to interference.[21/]

Neither the distance nor the shielding assumption applies in any of a number of critical land and marine safety-related applications where mobile GPS receivers and mobile MSS transceivers can be expected to interact. For example, in the case of an ambulance using GPS to find a reported accident scene, the ambulance may be traveling side-by-side with a car containing a passenger who is using an MSS transceiver. The separation may be 3 meters or less. In this case, the protection due to path loss shrinks by a factor of 100 — or 20 dB. In addition, the ambulance frame will not necessarily shield the GPS antenna from the radio emission, and so the differential antenna gain becomes 0 dB, not the 15 dB assumed in the aircraft landing scenario. Even without considering other factors, the effect on the overall link budget is significant.

Furthermore, the –70 dB assumption was based on continuous tracking, not reacquisition, which can occur in urban canyons and crowded harbors. In these cases, the necessity for reacquisition is triggered by the physical topology. It is therefore vital that it not be inhibited by man-made interference. Regulation that legitimatize this level of interference clearly does not serve the public interest.

D. The Commission Must Take Specific Action To Ensure That Any Public Safety Service Operations At 794-806 MHz Or Anywhere Else Do Not Cause Harmful Interference Into The GPS Bands.

Since the proposed public safety use of the band would, in fact, result in operational harm to public safety, the GPS Commenters believe that it makes no sense for the Commission to engage in a "traditional" weighing of the impact of imposing stringent standards

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21/ A separation of 30 meters results in an attenuation of the MSS signal due to path loss of 66.1 dB. The airframe blocking results in a differential antenna gain of at least 5.5 dB.

on the makers of 700 MHz equipment..[22] The need to protect GPS is and must remain the Commission's paramount objective. If GPS is not protected, it does not matter what positive attributes an insufficient criterion may offer the prospective makers of equipment for the 700 MHz band -- the criterion would have to be rejected. The GPS Commenters can conceive of no circumstance under which it would be consonant with the public interest for the Commission to adopt rules that establish the groundwork for a *new* public safety system that would, by its very existence, endanger a dynamic, growing, and absolutely vital *existing* public safety service.

The Commission must thus ensure the protection of the GPS user base by refusing to adopt any emission standard that would jeopardize the operation of GPS receivers and that would be counter to existing public law requiring the prevention of disruption and interference to GPS.

At this time, and given the fact that the public safety applications contemplated for the 794-806 MHz band would cause harmful interference to GPS in many land and marine scenarios (as well as in aviation situations), there is no reason to pursue the Commission's inquiry into the feasibility of restricting mobile use near airports.[23] Because millions of potential victim GPS receivers are currently in use, and due to the inability of these or future receivers to be made more robust to harmonic interference, there also is no reason to pursue a transition plan to more stringent levels for 700 MHz equipment.[24]

22/ *See* NPRM, FCC 98-191, slip op. at 90 (¶ 196).

23/ *See Id.* at 93 (¶ 200).

24/ *See Id.*

Next, the GPS Commenters question the relevance of the Commission's desire for "a better understanding of the levels of radio energy that currently exist in the GNSS spectrum as a result of spurious emissions from other communications systems and electronic equipment."[25/] To be sure, there are many interfering sources to GPS, and the most significant of these is the METs for 1.6 GHz MSS systems that would operate in the adjacent bands.[26/] This OOBE interference number for MSS handsets was negotiated before the Presidential Decision Directive on GPS confirmed the standard of continuous availability of GPS which was further protected in statues. However, the fact remains that 700 MHz equipment would, by itself, introduce harmful interference to GPS. It also is the case that the presence of interference from any other source would not relieve the Commission from ensuring that operators of 700 MHz equipment do not cause interference to GPS users at harmful levels. If anything, the existence of interference from other sources heightens the need for the Commission to be vigilant in ensuring that no additional interference is introduced to the GPS band.

Finally, the GPS Commenters note that the removal of Selective Availability, the intentional degradation in the timing of the GPS signals, would have no impact on the proposed interference situation.[27/] Interference directly attacks the ability of the GPS receivers to acquire

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25/ *Id.* at 92 (¶ 199).

26/ *See* Council Consolidated Reply to Opposition of AirTouch Satellite Services, U.S. and Globalstar, L.P. in File No. 1367-DSE-P/L-97, at 9 (filed July 31, 1998).

27/ *See* NPRM, FCC 98-191, slip op. at 91 (¶ 198) (suggestion of the National Public Safety Telecommunications Council ("NPSTC")).

and track the signals from the satellites. The absence of Selective Availability does not repair or mitigate the damage done by interference.[28/]

The GPS Commenters do not idly or lightly suggest that there may be a need for the Commission to make the emission standards it has proposed in new Section 90.553 of its rules more stringent.[29/]

In the end, however, and if no other alternative or solution materializes before the Commission is prepared to take final action on its proposal, the GPS Commenters believe that the following modifications to proposed new Section 90.553 are the minimum changes that would be necessary to ensure protection of GPS receivers from the harmful effects of the second harmonic emissions of transmitters operating in the 794-806 MHz band:

> § 90.553 GNSS protection.
>
> In order to provide adequate protection to receivers of the Global Navigation Satellite System (GNSS) which will utilize the Radionavigation-Satellite Service (space-to-Earth) band, mobile units must meet a minimum second harmonic

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28/ The GPS Commenters also note that the military stewards of GPS may have different reasons for objecting to the suggestion made by NPSTC.

29/ Certainly, it behooves the Commission and the industry to explore the viability of such options as requiring makers of 700 MHz equipment to mitigate interference to GPS through the use of notch filters at the transmitter front end to remove spikes in the second harmonic. The economic impact of such a technique should not be prohibitive and is required to protect the equity of their own proposed public safety customer base.

suppression standard in the frequency range of 1559-1605 MHz of ~~90~~ **[120]** dB down from the maximum effective radiated power of the carrier and handhelds and portable units must meet a minimum second harmonic suppression standard in the frequency range of 1559-1605 MHz of ~~80~~ **[110]** dB down from the maximum effective radiated power of the carrier. This standard applies only to equipment operating in the frequency range of 779.5-802.5 MHz.

The GPS Commenters note that such a solution should be technically feasible. After all, the MSS MET achieves an attenuation of 66 dB in 5 MHz to help protect the GNSS band. Certainly, harmonic suppression of 120 dB should be feasible over a frequency span of 794 MHz.

In sum, the importance of the protection obligation the Commission has with respect to GPS cannot be overstated. Economic considerations, while always relevant, simply cannot be permitted to dictate the outcome of this issue.

E. The Burden Of Evidence Must Be On Public Safety Service Operations At 794-806 MHz To Show That They Do Not Create Harmful Interference In The RNSS/ARNSS Bands.

GPS operates in an RNSS/ARNSS band in order to ensure that signals used for public safety purposes are protected from harmful interference and disruption. In addition to international protection requirements of ITU Radio Regulations (e.g., S4.10), the protection of GPS signals has been the subject of Congressional legislation which has been signed by the President.[30/] As a consequence of these considerations, the burden of evidence must reside with those proposing new operations at 794-805 MHz to show that they do not create harmful interference in RNSS/ARNS bands now used by GPS and GNSS systems. It is not the

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30/ *See* H.R. 1702, Commercial Space Act of 1998 and H.R.1119, National Defense Authorization Act for Fiscal Year 1998.

responsibility of existing safety services to show the proposed operation creates harmful interference.

The burden of evidence question is simple and crucial in public safety situations. The U.S. Government has long experience with safety analysis and the development of criteria of making safety-related decisions. One of the most dramatic examples of failure to adhere to established decision-making procedures occurred with the loss of the Space Shuttle *Challenger*. During the night before the launch, NASA and industry engineers debated the possibility that extreme cold weather at the launch site would impair the large o-rings used in the Shuttle's Solid Rocket Boosters or that ice on the pad would damage the vehicle on launch.[31/] The Commission found a disturbing pattern in the pre-launch decision process. Engineers were challenged by management to show that it was unsafe to launch rather than to prove that it was safe – which was the established requirement for committing to a launch. This reversal of proper procedure occurred imperceptibly at the time, but with disastrous consequences in hindsight.

If NASA had followed its own procedures in requiring evidence that it was safe to launch, there were multiple reasons for delaying the *Challenger* launch. Asked to prove it was unsafe, the responsible engineers said they could not do that and thus a "go" for launch was approved. Similarly, the Council has shown there are multiple reasons for concern with new public safety radio operations in the band 794-806 MHz. The Commission must protect the existing user community that relies on GPS by refusing to adopt any emission standard that is not

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31/ *Report of the Presidential Commission on the Space Shuttle Challenger Accident*, U.S. Government Printing Office, June 6, 1986, at. 94, 116.

proven safe in avoiding harmful interference or disruption to GPS receivers. Such proof has, to our knowledge, yet to be provided to the Commission or the GPS Commenters.

IV. CONCLUSION

Millions of people worldwide rely on the stability, continuous availability, and integrity of the GPS service that is provided by the U.S. Government and confirmed in the U.S. Presidential Decision Directive and various statutes. The continuous, market-driven evolution of passive receiver technology is premised upon the predictable integrity of the GPS spectrum.

For all of the reasons stated above, the Commission must be prepared to impose the most stringent emission limitations for the second harmonic emissions from mobile equipment in the 794-806 MHz band in order to protect all public safety applications -- land and marine, as well as aviation -- of GPS in the 1559-1605 MHz band.

Respectfully submitted,

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